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EXAMINER	
PADGETT, MARIANNE L	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 10/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/608,521	RAFAC ET AL.
	Examiner	**Art Unit**
	Marianne L. Padgett	1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

. Use of undefined abbreviations or acronyms in the claims is vague and indefinite, as it makes it uncertain what exactly is being claimed. In independent claim 1 see "DUV", used in the phrase "DUV or shorter wavelength light" or in the exposing step requiring "a sufficient amount of DUV radiation". It is further noted that no definition of this abbreviation was found in the body of the specification, although single exemplary examples, such as on page 3, line 23 teaching "DUV (e.g., 193.368 nm) light". However, a single example does not provide what range of ultraviolet light, hence lacking any clear definition, the claims will be considered to be directed to all ultraviolet wavelengths and all wavelengths shorter than UV, noting that ultraviolet radiation is generally considered to encompass the wavelength range of 100-400 nm or 101-400 nm, with 100-200 nm sometimes called "vacuum ultraviolet". Note that applicants may provide a definition for DUV to the specification, and hence claims, with a prior art reference containing a definition thereof.

Further undefined & unusual abbreviations are seen in claims 2 (Bp) and claim 4 (M or B), which while modifying numerical amounts, do not represent any typical unit abbreviation. It is noted that on page 4, line 11 there is a teaching concerning "about one billion laser light pulses (the "Bp")...", however no lasers have been claimed to be used, nor is this any standard unit of measurement, hence the claim of "radiation exposure amounts to energy of at least the equivalent of about 2Bp at 9mJ per pulse" does not provide any clear amount of energy that can be determined by the examiner or compared to whatever essentially undefined wavelength $\leq$ DUV that is employed. In claim 4, while the examiner might guess that "700 M to 1B pulses" is intended to represent 700 million to one billion pulses, this is a guess only, and abbreviations of the words for numbers are not standard nomenclature for identifying quantities

standing alone (M = mega = 10^6, & G = giga = 10^9, but these are used as a prefixes for units, not by themselves), thus the exact meaning of this claim may be considered unclear.

Claims 2-4, which require exposure amounts "at least the equivalent of "...[claimed value] "mJ per pulse" is further unclear, since it is impossible to meaningfully determine what an equivalent amount of energy might be, given that the area over which the exposure of a single pulse or the pulse's diameter are not provided, nor is the type of radiation source, i.e. lamp or laser, claimed, such that one has no idea if one is considering "about 2Bp at 9mJ per pulse" that is localized at a 2 mm diameter beam spot or spread over a 2X2 m area, conditions which will have entirely different effects, before one even considers that one has no idea from the claims what dielectric materials to which one is applying this uncertain amount of energy.

In the preamble of claim 1 the intent of "compaction/densification" is uncertain, as it is unclear if these two words are being presented as synonyms having the same scope, i.e. alternatives meaning the same thing, or if they are intended to be two different actions with different scopes. Line 13 of claim 1 directed to "to induce sufficient densification..." and claims 7 & 6 with limitations to "a specific reduction in compaction...", separately discuss the terms, providing further uncertainty to their relationship.

In claim 1, the scope of "multi-layered dielectric reflectivity coating" is unclear, because what is being reflected has never been defined. The reflectivity could be referring to reflection of physical objects, either large (i.e. macroscopic), or small (microscopic), or could be referring to electromagnetic radiation of any wavelength, which may or may not include the DUV wavelengths of the process, etc., thus exactly what is being treated is relatively undefined, as the substrate can be any material, where the multilayered dielectric coating is also not limited to what type of dielectrics may be used, i.e. any plastic or any ceramic, etc., that has any range of dielectric properties may be employed, and whether the layers' affect on reflectivity is negative or positive is also not to follow and.

Note with respect claims 5 & 7, that since the layers do not necessarily have any hydroscopicity, and since there is no clear relationship between the densification or density, and the hydroscopicity, that may not exist, determination of the amount of UV radiation based on hydroscopicity is problematical.

3. Claim 3 is objected to because of the following informalities: in claim 3 the phrase "radiation exposure amounts the energy being delivered in at about 3 kHz pulse repetition rate" is non-idiomatic English. Appropriate correction is required.

4. The disclosure is objected to because of the following informalities: on first usage in the specification abbreviations should be defined, such as "DIA" or "mR" online 26 at page 1, or DUV on page 2, line 24, or DV on page 3, line 10, etc.

Appropriate correction is required.

5. Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

See above discussion of DUV in section 1, noting that lacking a definition of the range of wavelengths encompassed by DUV makes it possible for the practitioner to determine what wavelengths are applicable to the process, thus fails to comply with the enablement criteria for the specification.

It is noted that various meanings for the acronym "DUV" were found to include "Deep ultraviolet", "Data-Under-Voice", and "Diffey weighted UVA irradiance", where the context of the claims & specification would appear to indicate the first meaning, however various patents that employ this term to mean deep ultraviolet were found to provide different ranges to define it, thus substantiating the above 112 first and second rejections concerning DUV. For example, see Besser et al. (6,383,947 B1) on col. 1, lines 58-60 which states "DUV radiation can be loosely defined as radiation between the wavelengths of 4-400 nanometers (nm) "; while Forbes et al. (6,365,333 B2) on col. 4, line 67, col. 5, line 3 provides an

incomplete definition stating "DUV includes those wavelengths that are less than or equal to approximately 254 nm (e.g. includes 193 nm, 248 nm, and other wavelengths)...", since the "includes" feeds the extent of the range open); and Adams et al. (6,410,209 B1) on col. 2, in the first full paragraph on lines 11-12 teaches "deep ultraviolet (DUV) light (300 nm or less in wavelength), which gives a maximum but is open ended up for the lower wavelengths, thus these references provide no clear range limit.

The claims may be considered further nonenabled in that no disclosure was found in the specification as to what materials may be employed for the "multi-layered dielectric reflectivity coating", thus not enabling one of ordinary skill in the art to determine what materials may be employed with the claimed treatment to produce the claimed effect. The examiner notes that applicant does refer to various mirrors which were treated, such as "ARO OPuS high reflectivity mirrors", said to have a fused silica substrate (page 4), or "and ARO high density film on a calcium fluoride... substrate... part number 119679, and Corning samples with different film formations..." (page 5), but none of these references to trade names, companies or part numbers provides any teachings to what materials are actually being treated in the claimed process, nor are the undisclosed materials used in trade named products, etc., necessarily immutable, hence any attempt to amend the specification for what coatings were employed on the named mirrors, etc., must be supported by appropriate prior art showings of what those trade names, etc. encompassed.

It is noted that what material, i.e. what dielectrics are being treated & how it was formed, is very important to whether or not there are potential problems with respect to compaction or densification during use with DUV. For example JP 4-228560 to Takashi et al. teaches a dielectric multilayer film with the appropriate resistance to be used in environments exposed to high temperatures, such as optical parts for a higher output and high repetition laser of UV rays, where the technique produces a product where the optical and physical constants, such as refractive index and density, are stabilized, and the film may be

used as a reflection increasing film (abstract), with figures showing multilayer oxides, Such as alternating alumina and silica, and with col. 5- 6 of the Japanese patent appearing to indicate use of wavelengths of 248 nm or fròm a KrF radiation source (i.e. DUV). Alternately, Ruffner (5,911,858), in its background (col. 4, lines 29-67), indicates that while some materials, such as silicon dioxide used in lenses absorb small on amounts of radiation at 193 nm such that the radiation is converted heat causing recrystallization so that the lens undergoes optical compaction, other dielectric materials such as CaF_2 is less susceptible to absorption problems at 193 nm, but has other problems such as stress induced birefringence, thus again showing the importance of identifying materials employed for the claimed exposure technique to be meaningful with respect to densification, as well as showing that there is no support for nor reason to expect, all dielectric materials or all multi-layered dielectric materials or all multi-layered dielectric "reflectivity" coatings to be affected in a like manner by any particular wavelength of DUV or by all wavelengths of DUV.

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of

each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 1 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ruffner (5,911,858).

First, with respect to claim 1 it is noted that the "exposing..." step, as written, will read on mere use of a multilayered dielectric "reflectivity" coating (capable of minimal or major densification) during the normal course of its lifetime, for any time during which exposure to DUV may cause densification, noting that when no more densification is possible, i.e. it's fully densified (whether or not it has had detrimental effects on the coated substrate with respect to its intended use), the claim process is complete.

Ruffner recognizes the problems caused by deep UV and extreme ultraviolet (EUV) wavelengths on optical lenses or mirrors, including compaction (col. 4, lines 29-67), teaching the use of multilayered, high reflectance coatings for optical devices such as mirrors to be used with DUV or EUV (col. 5, lines 1-24; col. 8, lines 9-67+; col. 10, lines 3-35+), where the importance of determining the optimal thickness for particular parameters, such as wavelengths and angles of incidence, is discussed (col. 12, lines 2-26+; col. 14, lines 30-49; and the sequence of steps described in col. 15, lines 5-col. 17, line 18 & figure 6), with exemplary alternating layers for reflective coatings discussed in col. 13, lines 18-67, especially table 1 disclosing pairs of dielectric layers for use at 193 nm including aluminum oxide with one of silicon dioxide, magnesium fluoride or calcium fluoride. In step 440 (col. 17, lines 14-17) appropriate radiation, such as 193 nm ArF laser radiation, is applied to the multilayered mirror for characterization thereof, with further teachings of use for the multilayered dielectric reflective films as taught by Ruffner suggesting use at such wavelengths, thus providing teachings of exposure of claimed subjects to claimed the UV radiation, which will inherently produce the claimed effect during the lifetime of the coated mirror, or alternately, it would've been obvious to one of ordinary skill in the art that during the use of the product of

Ruffner's process maximum densification would have been expected to be achieved, where one of ordinary skill would further consider Ruffner's teachings concerning compaction in the prior art, such that its potential effects would have been expected to be considered in the overall process.

8. Claim 1 is rejected under 35 U.S.C. 102(b or e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Belleville et al. (6,180,188 B1 or 6,387,517 B1).

Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Belleville et al. (188 or 517).

Belleville et al. (188) teach preparing optical material by the depositing on a substrate (organic such as plastic, or inorganic such as glass) at least two layers of inorganic polymeric material, such as alternating high & low index of refraction layers containing metal oxide such as Ta_2O_5, and silicon oxide or manganese oxide, where the optical material may be used for reflective material in dielectric mirrors for reflecting wavelengths, such as between near ultraviolet to near infrared. While the layers may be individually densified/crosslinked with DUV radiation of wavelengths from 180-280 nm from a UV lamp (excimer lamp), it is also taught to densify the assembly of layers via UV exposure of those wavelengths, where the UV dose received by the layers must be sufficient to induce crosslinking, with exposure generally conducted at energies of 5-10 J/cm^2 four times of 10 seconds-10 minutes, with power in the region of 350 mWatts/cm^2. The UV densification process is noted to affect the refractive index of the layers by increasing it, and to provide various advantages such as reduction in production time for multilayered coatings, suitability for temperature sensitive substrates, and affecting the wettability of the surface after exposure to UV for densification. In Belleville et al. (188) particularly see the abstract; col. 1, lines 7- 47, noting use of such materials for dielectric mirrors used with high energy lasers; col. 7-8, especially col. 7, lines 5-13 & 38-col. 8, line 20; col. 9, lines 19-47+ particularly directed to reflective material for mono or polychromic dielectric mirrors; col. 10, especially lines 3-6 & 24-35+4 metal or metalloid oxides to be crosslinked/densified by UV; col. 12, lines 26-28 & col. 13, lines 31-45

for effective UV exposure on refractive index of silica or tantalum oxide, etc.; col. 14, lines 31-52 for procedural outline & col. 14, lines 62-col. 15, lines 42 for UV exposure parameters; col. 16, especially lines 32-62 for another procedural outline; col. 17, lines 10-36 Ford van itches of using UV & lines 37 plus, especially 55 to 62 for use in preparing wide spectrum than reflective material; example 14 preparation of a bi-layer optic material of high index layer of tantalum oxide & a low index layer of silicon dioxide, where final crosslinking/densification of all layers by exposure to taught UV is employed; and claims, especially 1-2, 4-5, 8 & 13-31.

Belleville et al. (517) has teachings substantially similar to those of (188), however as can be seen in example 4, bridging col. 25-26, additional teachings concerning the effect of UV radiation on the refractive index & the thickness of the layer are presented, particularly stating that "the change in the refractive index n and the thickness of the layer e are both functions of the number of passes under UV" (col. 25, lines 63-65). Examples 5 & 6 on col. 26-27 are also directed to UV exposure techniques.

While both Belleville et al. references teach UV densification of materials that read on those claimed, they do not explicitly teach that further exposure to some wavelength of DUV or shorter radiation will not cause some densification, however whether or not the taught this densification is sufficient to cause maximum densification (i.e. where none more will occur), the densification that is performed inherently inhibits further densification to some degree if/when subsequent exposure to taught or claimed wavelengths occur, due to the elimination of compositional or microstructural features that are less dense or porous during the taught UV treatment. Alternately, it would've been obvious to one of ordinary skill in the art to optimize the taught exposures so that the cross-linking reaction & densification process goes to completion so that the optical characteristics of the produced optical product will not alter during use, especially considering the teachings within the references that the UV densification process affects the refractive index of the materials employed, and considering that in order to form this multilayered coating for affecting reflectivity characteristics, one is employing multiple layers of different

refractive indexes, such that it is clearly recognized that the refractive index employed is important & controlled. In Belleville et al. (571) this concept is further obvious due to the explicit teaching of both the refractive index and thickness of the layer being functions of the number of passes under UV, which can be considered equivalent to doses of UV.

While there are no teachings that match applicants' claims to the amounts of energy employed in the radiation exposures, the amounts in these claims as discussed above in section 1, cannot be clearly determined, hence no meaningful comparison can be made, however considering the above discussion concerning the degree of densification/crosslinking, it would've been obvious to one of ordinary skill in the art to optimize the exposure dosage so as to complete the densification for reasons as discussed above, which given no clear differentiation between the materials of Belleville et al. and those claimed, would have been expected to be effectively equivalent energy dosages.

As noted above, both Belleville et al. teach that the UV exposure of these coatings that affect reflectivity, also affects the wetting ability of the exposed surfaces, a property which is related to hydroscopicity, and as discussed above the amount of UV exposure would have been expected by one of ordinary skill in the art to affect the degree of cure/densification, thus it would've been obvious to one of ordinary skill in the art who desires certain properties in the resultant optical multilayer product, to determine the dosages required to optimally produce the desired product, which since it may relate to wetting ability and densification, it would have been obvious to analogously determine dosage for hydroscopicity & compaction, which are related properties.

9. Claims 1-2 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Pan et al. (2002/0001672 A1).

Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al.

Pan et al. teach making diffraction gratings for lasers producing wavelengths of 248 or 193 nm, i.e. KrF or ArF excimer lasers, where preferred embodiments include depositing over a pure dense coat of

aluminum, two or four layer structures that protect the aluminum and improve the normal reflectivity of the desired wavelengths, where combinations of those layers include MgF_2+ SiO_2, or MgF_2+ Al_2O_3, which are dielectric. It has taught that the multilayered structures are necessary to protect the grading from degradation beyond use with 2 billion pulses, where exemplary test pulses include 10 mJ per pulse (abstract; figures 8, 9B, 9C, & 12; [0002]; [0006-8]; [0027- 48, especially 27-29 for tests or use up to and beyond 2 billion pulses 31, 35, 37-40 & 46-47, for particular multilayers & their use in further increasing the reflectivity; noting [0043] teaches it is especially important to use the multilayer coating with high power UV lasers & [0045] noting that other techniques of applying the taught dielectric layers may be employed). Thus, Pan et al.'s teachings of using the multilayered structures beyond 2 billion pulses is considered inclusive of such exposure, and that it would read on the requirement of "at least the equivalent of about 2Bp at 9mJ per pulse" in the scope that it might possibly be interpreted in light of applicants' specification. It is further noted that the silicon oxide or aluminum oxide materials, treated by such a radiation are effectively/inherently been annealed, such that any defects or process the in the deposited oxide layers would inherently be compacted or densified, such that during use maximum densification would have been expected to be achieved. Alternately, while paragraph [0029] suggests that the multilayer protective structures are required to protect grading surfaces from degradation beyond about 2 billion pulses, they do not explicitly state that such number of pulses are necessarily applied to their taught two and four protective dielectric layer structures for improving reflectivity, however given this teaching it would've been obvious to one of ordinary skill in the art to use them with that number of pulses and more, thus reading on the claims has written.

While the particular pulse repetition rate or the 15-18 mJ per pulse... parameter limitations of claims 3 and 4 are not present in Pan et al., the generic teaching for use of these grating structures for high-energy excimer lasers, would've been expected to be employed for a variety of energies depending on particular use, such that energy such as those claimed which are within an order of magnitude of

exemplary test pulses' energies, would have been expected by one of ordinary skill in the art to be useful therewith, and the rate at which the laser pulses are delivered would have been expected to be inclusive of the range of pulse repetition rates available to excimer lasers, which would have been expected to be inclusive of the claimed rate, which as presently claimed has no significance with respect to effect, as it is applied to delivery of energy of undeterminable amounts to insufficiently defined materials.

10. Other art of interest to the state-of-the-art includes: Callies et al. (2004/0190111 A1), teaching further use of optical components with multilayer coating is that affect reflective & transmissive properties (abstract; figures 8-9; [0057], [0078], [0082- 85, especially 85]); and Callegari et al. (2006/0040513 A1), which is not prior art, but has teachings of interest concerning DUV laser annealing SiCOH dielectric films to improve their properties.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marianne L. Padgett whose telephone number is (571) 272-1425. The examiner can normally be reached on M-F from about 8:30 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MLP/dictation software 10/16-19/2006

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